Financial crisis and the choice of currency regimes in NEM Countries

EUSI/共同研究EU経済セミナー

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Motivation

- New EU Member (NEM) countries are preparing to accessing euro zone in near future. However, their exchange rate strategies have differed each other.
- World-wide financial crisis in 2008 hit some NEM countries seriously.
- Did their choices of exchange rate regime produce any differences of impact under financial distress?

Objectives

- First, analyze their exchange rate regimes empirically.
  - estimating implicit basket weights on euro
  - Calculating the z-score of NEM currencies
- Then, investigate the relationship between exchange rate regimes and long-term government bond spreads in NEM countries for the period between January 2001 and December 2008.

Contents

- Section 2: Previous studies
- Section 3: Exchange rate regimes of NEM
  - estimated by two different methods
- Section 4: The determinants of bond spreads
  - Financial market integration in NEM
  - The long term bond spreads in NEM
- Section 5: Empirical analysis
  - investigate the relationship between the choice of exchange rate regimes and bond spreads
- Section 6: Conclusion

Previous works

- Krawczyk (2004)
  - Adopting ERM-ll may result in a serious financial instability in CEE countries.
- De Grauwe and Schnabl (2004)
  - The pegged exchange rate did not reduce NEM countries' growth rates and brought the benefits of more trade and lower interest rates.
- Arratibel, Furceri, and Martin (2008)
  - Lower exchange rate volatilities were associated with higher growth in CEE.
- Darvas and Szapary (2008)
  - Hard-peg countries in NEM were no room to let the nominal exchange rate appreciate to accommodate the price level convergence.

6 The exchange rate regimes in NEM

Official Monetary Policy Strategies of CEE countries

	Exchange rate regime	Monetary policy strategy	Features
Bulgaria	peg to euro	Exchange rate targe	(with Currency Board)
Czech	Managed floating	Inflation target (1998)	
Cyprus	Fixed (euro since 2008)		
Estonia	ERM II with +/-15%*	Exchange rate targe	(with Currency Board)
Malta	Fixed (euro since 2008)		
Latovia	ERM II with +/-15%**	Exchange rate targe	
Lithuania	ERM II with +/-15%*	Exchange rate targe	(with Currency Board)
Hungary	Floating	Inflation target (2001)	(crawling peg)
Poland	Floating	Inflation target (1998)	(crawling peg)
Romania	Managed floating	Inflation target (2005)	
Slovakia	Fixed (euro since 2009)	(Inflation target)***	
Slovenia	Fixed (euro since 2007)		

Source: ECB, Arratibel, Furceri and Martin (2008), Darvas and Szapary (2008)

*: InEstonia ad Lithuania, their nominal band of ERM II is +/- 15%, however their actual band is 0%

**: In Latovia, their nominal band of ERM II is +/- 15%, however their actual band is +/- 1%.

***: In Slovakia, the inflation target was set below 2% at end-2007 and at end-2008.

Estimated Euro Coefficients by Frankel and Wei (1994)

- According to Frankel and Wei (1994), we identify exchange rate regimes.

$$\dot{e}_{i/kt} = a_0 + a_1\dot{e}_{Euro/kt} + a_2\dot{e}_{US/kt} + a_3\dot{e}_{UK/kt} + \varepsilon_t$$

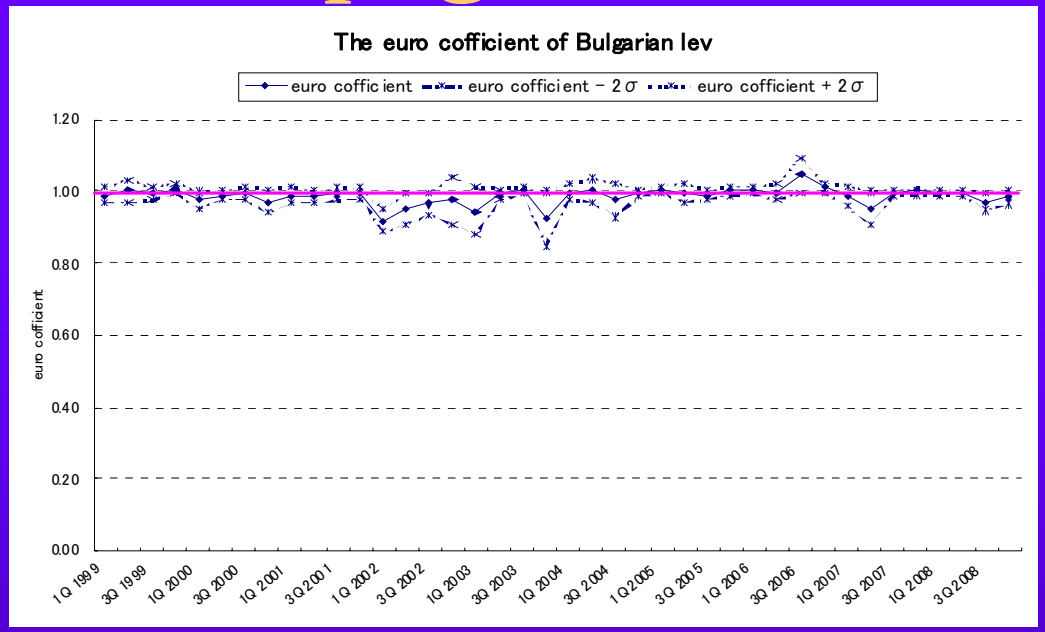
- The coefficients (a_1, a_2 and a_3) are interpreted as weights of the three major currencies.
- How to decide a numeraire currency *k* of anchor currencies?

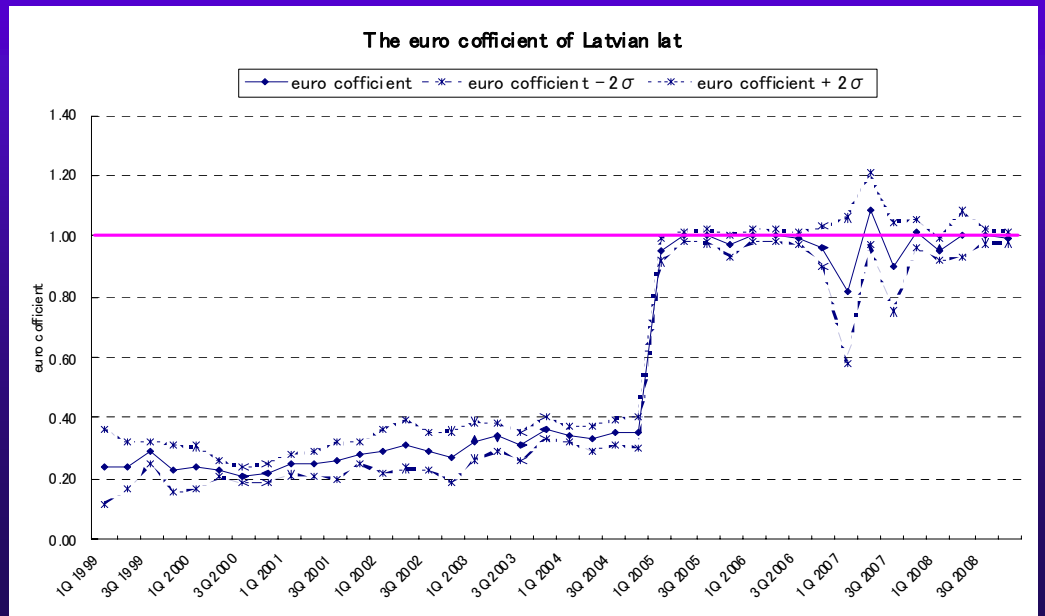
→ Japanese yen

$$\Delta \log e^{HOME/JPY} = a_0 + a_1 \Delta \log e^{EURO/JPY} + a_2 \Delta \log e^{USD/JPY} + a_3 \Delta \log e^{UK/JPY} + \varepsilon_t$$

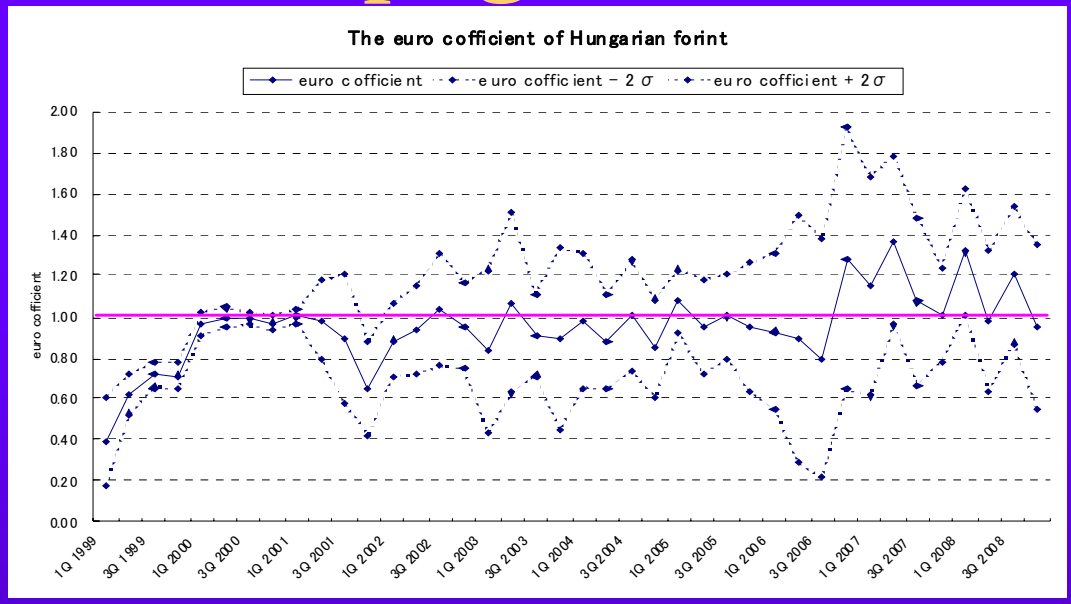
- Quarterly estimation from 2000-2008

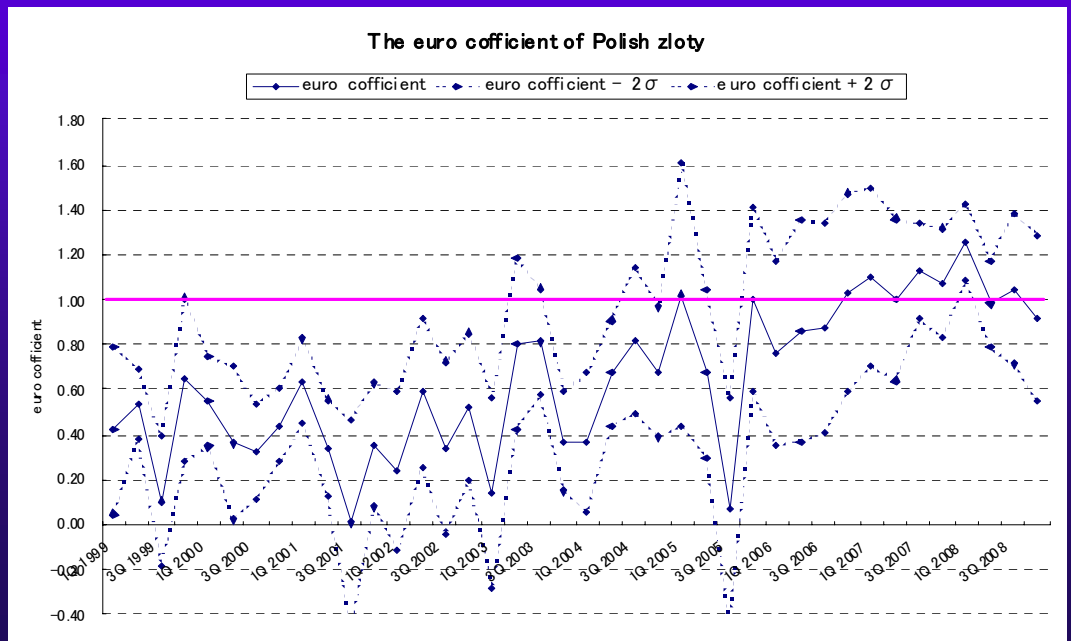
Hard peg currencies



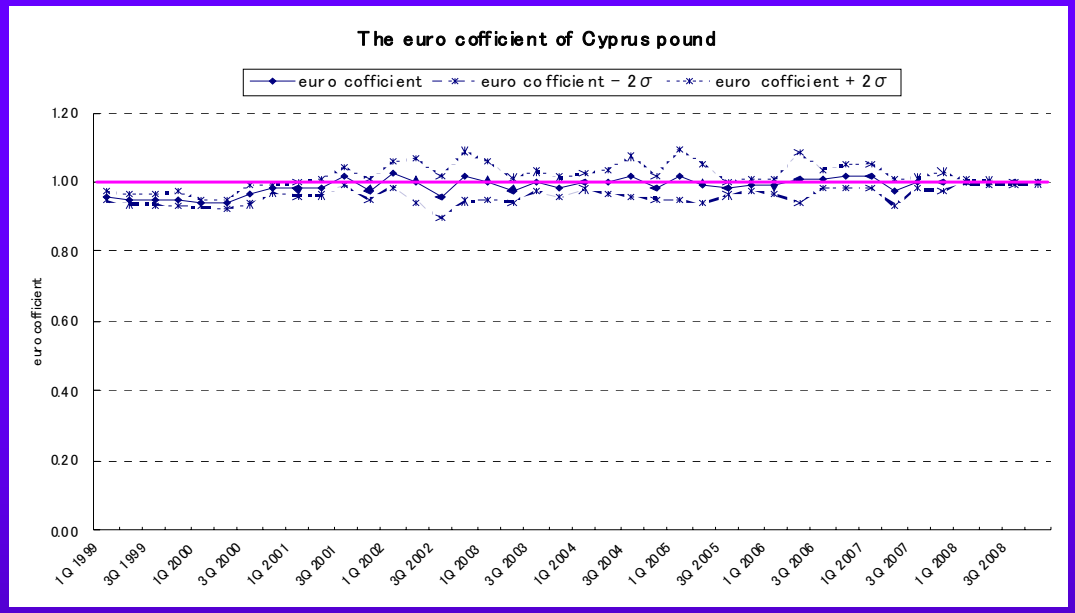


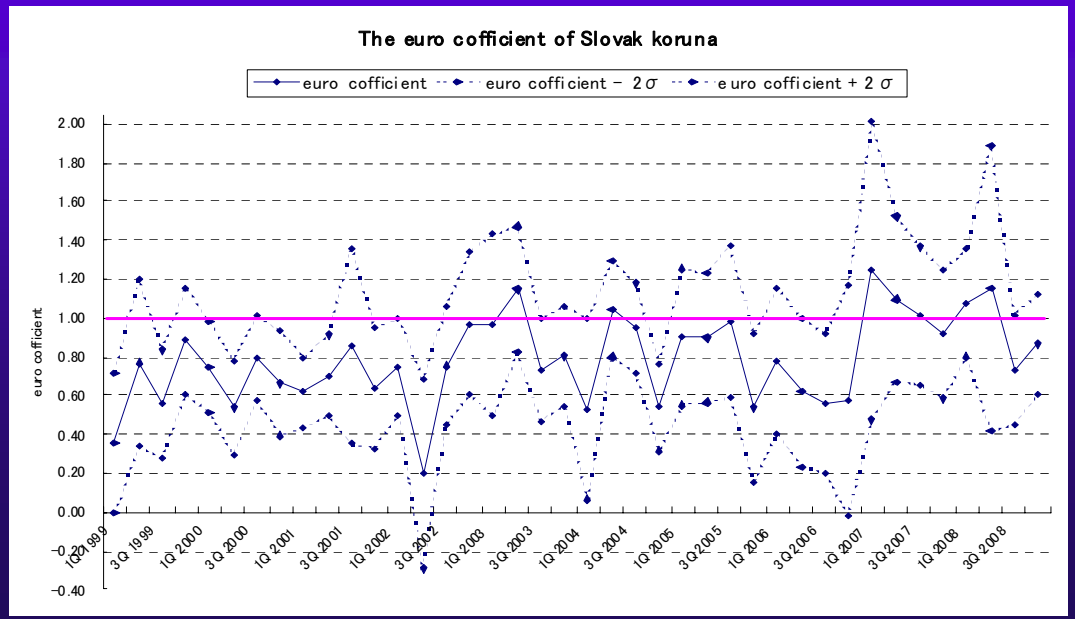
Soft peg currencies





Euro adoption currencies





The Z-score by Ghosh, Gulde and Wolf (2003)

- The z-scores incorporate both exchange rate fluctuations around a constant level and exchange rate fluctuations around a gradual depreciation / appreciation path.

$$Z_t = \sqrt{\mu_t^2 + \sigma_t^2}$$

The arithmetic average of month-to-month change in the nominal exchange rate vis-à-vis the euro

the standard deviation of the month-to-month changes of the nominal exchange rate vis-à-vis the euro

- If *z*-score is becoming lower, it means that the currency moves from soft peg regime to hard peg regime with the euro.

Z-score of NEM (Yearly)

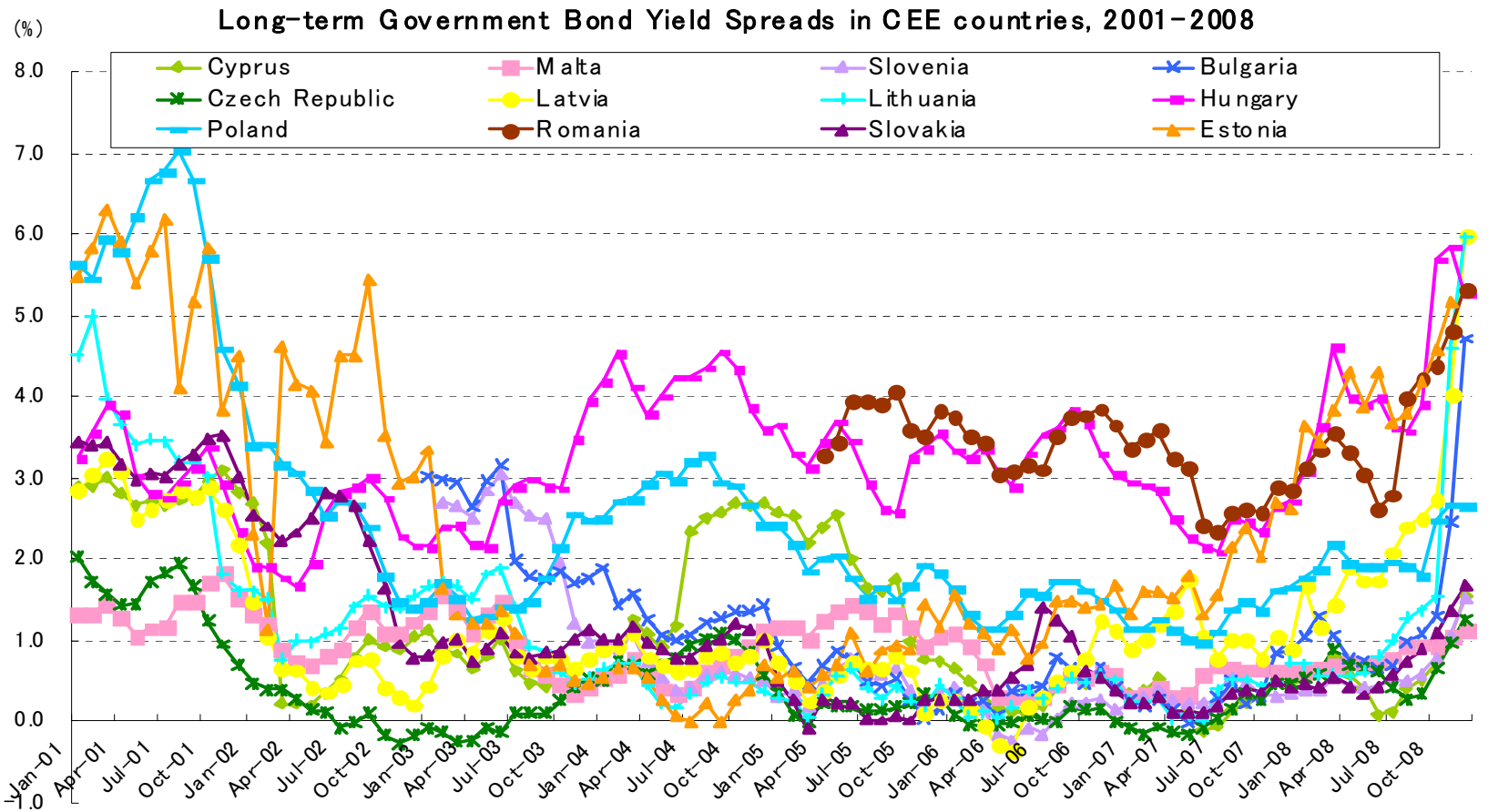
	Hard peg countries				Soft peg countries				Euro adoption countries			
	Bulgaria	Estonia	Latvia	Lithuania	Czech	Hungary	Poland	Romania	Slovenia	Cyprus	Malta	Slovaki
1999	0.17	0.11	1.60	2.45	2.38	1.14	2.66	5.31	0.84	0.16	0.86	1.55
2000	0.16	0.05	2.81	3.78	1.17	0.45	2.28	4.48	0.64	0.17	1.57	1.35
2001	0.13	0.06	1.65	2.40	1.62	2.35	3.94	2.63	0.37	0.33	1.02	1.12
2002	0.29	0.06	1.57	1.00	1.98	0.83	2.80	3.25	0.69	0.33	0.94	1.86
2003	0.23	0.06	1.86	0.02	1.18	2.63	3.42	2.02	0.26	0.52	0.61	0.94
2004	0.19	0.00	1.11	0.02	1.69	1.36	2.48	2.32	0.19	0.30	0.40	0.93
2005	0.03	0.00	0.07	0.00	1.36	1.56	2.86	2.15	0.11	0.42	0.27	1.57
2006	0.05	0.00	0.08	0.00	1.00	3.39	2.27	1.80	0.03	0.17	0.01	1.72
2007	0.05	0.00	0.77	0.00	1.60	1.56	1.64	2.63	0.00	0.14	0.01	1.59
2008	0.14	0.00	0.32	0.00	3.28	3.02	4.24	3.50	0.00	0.00	0.00	2.10

Author's calculation.
Source: Datastream

Financial market integration in NEM

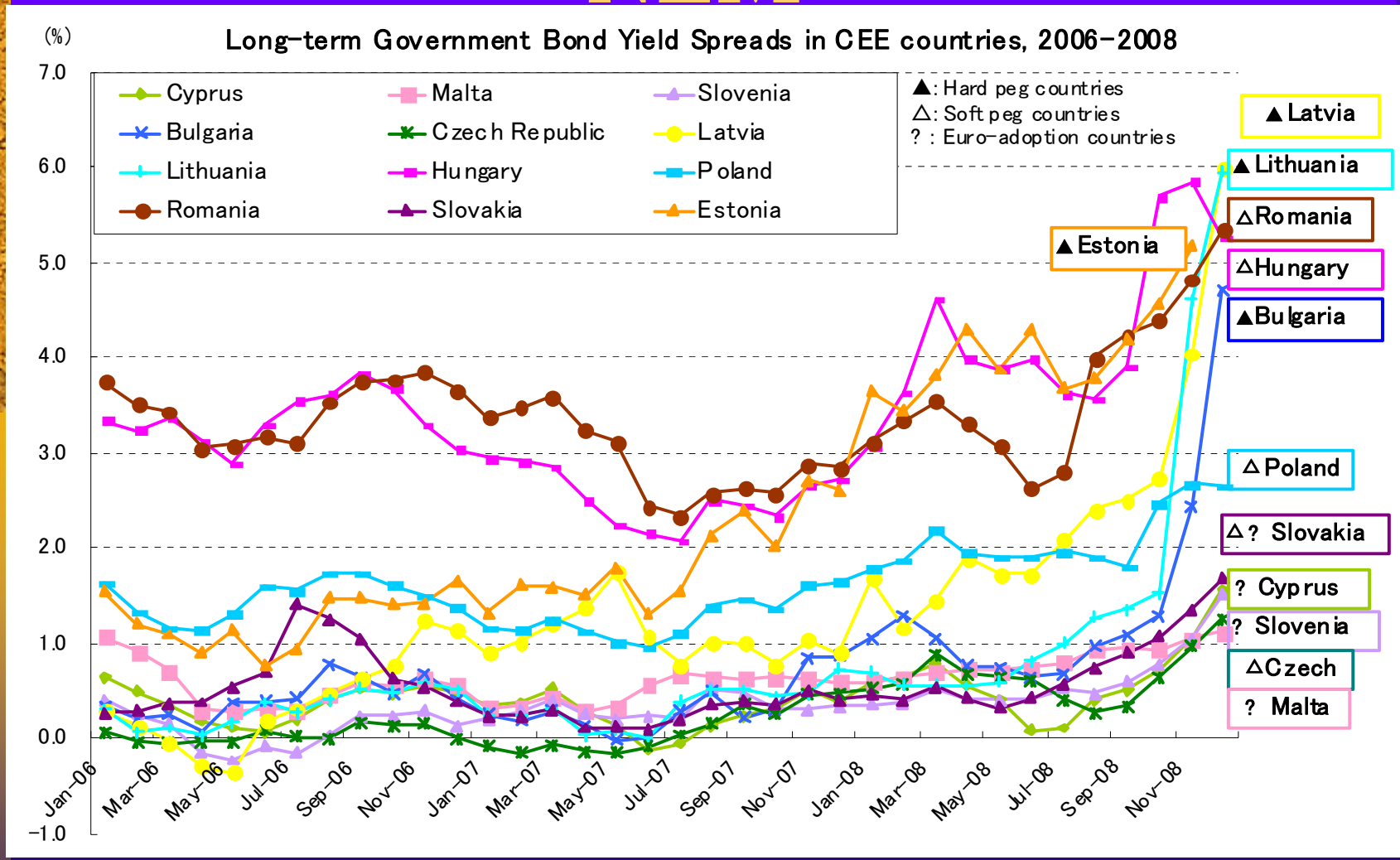
- Cappiello et al (2006)
  - Czech, Hungary and Poland exhibit strong co-movements both between themselves and with the euro area.
- Darvas and Szapary (2008)
  - There has been a substantial convergence of the nominal interest rates in NEM countries by 2007.
- Since 2007, however, the world-wide credit crisis has changed above trend of convergences.
- The yield spread widened enormously reflecting the degree of the influence of the credit risks, the each country's budged condition and liquidity.

Long-term Bond Spreads in NEM



$$Bond\ spread_{i,t} = Government\ bond\ \ yeild_{i,t} - German\ gevernment\ bond\ \ yield_{t}$$

Long-term Bond Spreads in NEM



$$Bond\ spread_{i,t} = Government\ bond\ yeild_{i,t} - German\ gevernment\ bond\ yield_{t}$$

Determinants of sovereign bond spreads in NEM

- Add to their macroeconomic performance, there are other determinants. For example,
- Strahilov (2006)
  - The yield spreads of Eastern European national bonds denominated in US dollars are affected by the country's fundamentals as well as an US interest rate.
- Hartelius, et.al (2008)
  - The expectations of future US interest rates and volatility in those expectations are also a key determinant of emerging market spreads.
- Ebner (2008)
  - The ECB reference rate and market volatility were the main driving factors to increase bond spreads in NEM.

Model Specification

- To identify the effect of exchange rate regimes on the bond spreads, we execute
  - **A regression model by country - Monthly data**
  - **A cross-country panel model - Quarterly data**
- The basic framework is the bond spread of NEM determined by
  - **Country specific variables**
    - Macroeconomic fundamentals
    - **Exchange rate regime**
  - **External control variables**
    - EU economic fundamentals
    - European market condition factors

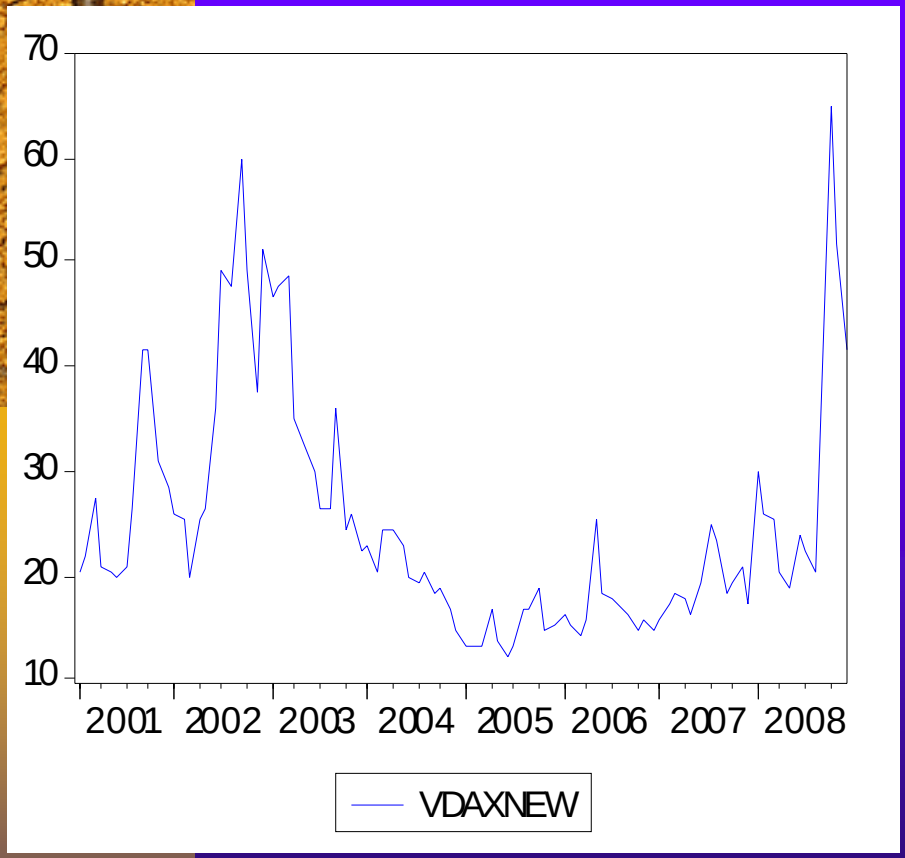
Explanatory variables

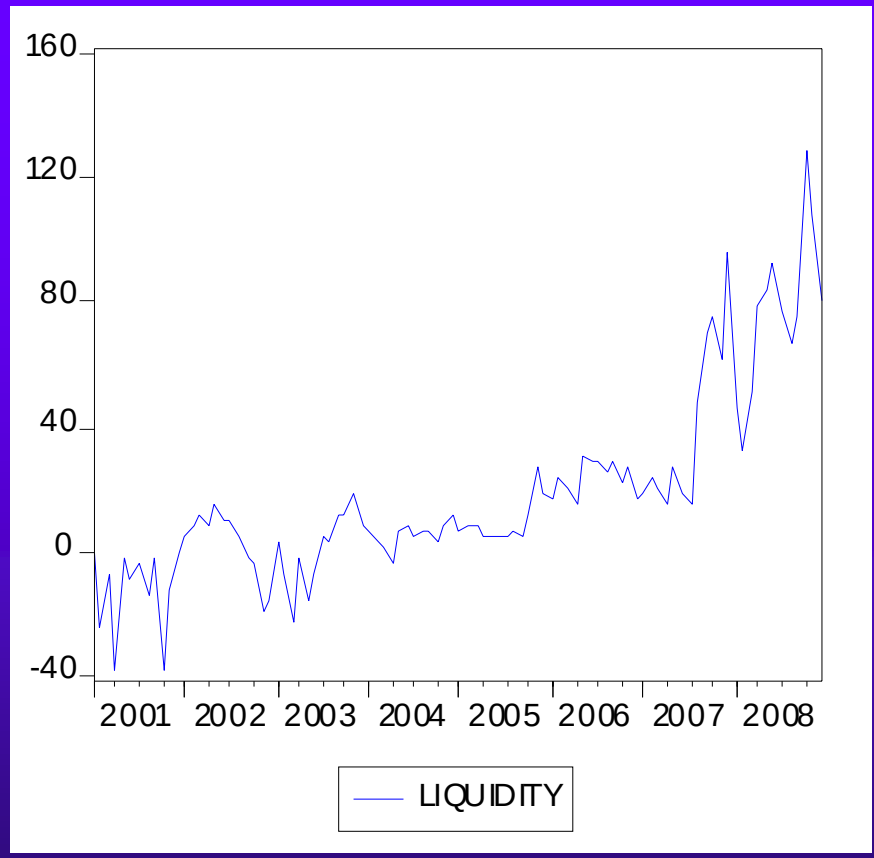
- Country specific variables
  - Macroeconomic fundamentals
    - government debt to GDP (DEBT), external balance to GDP (EXBAL), consumer price index (CPI) and industrial production (IP)
  - **Exchange rate regime** (for Quarterly Analysis only)
    - **Euro coefficients** (EUROCOEF)
    - **Z-score** (ZSCORE)
    - **a dummy variable for exchange rate regime** (REGIME, Fixed = 1)
    - Euro adoption dummy (EURO)
- External control variables
  - EU economic fundamentals
    - consumer price index in 15 EU countries (CPIEU15), industrial production in 15 EU countries (IPEU15)
  - European market condition factors
    - market volatility index (VDAXNEW) and market liquidity (LIQUIDITY)

European market condition factors

- We follow the model of Ebner (2008).
- Market Volatility index: **VDAX-NEW**
  - An expected 30 days market volatility of the German stock index DAX offered by Deutsche Börse (**VIX** by CBOE, **“investor fear gauge”**)
- Market liquidity: **Liquidity** (3month – O/N)
  - the difference between 3 month EURIBOR and O/N market rate (ECB)
  - The difference becomes small when the market is liquid.

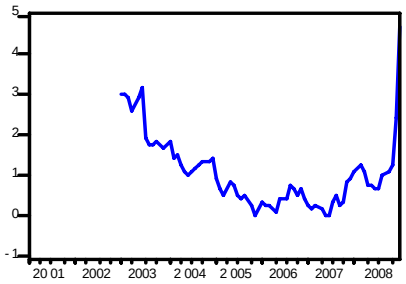
VDAX-NEW and Liquidity



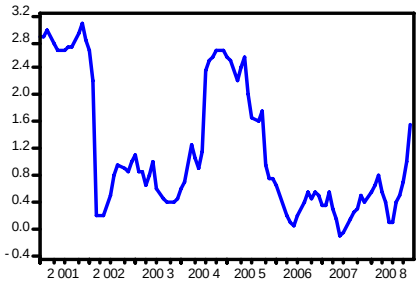


Bond spreads in NEM

Bulgaria

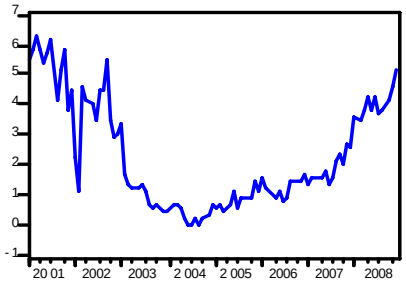


Cyplus



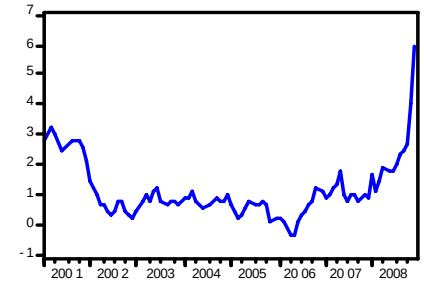
Czech

Estonia

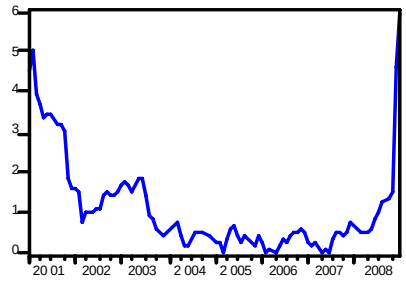


Hungary

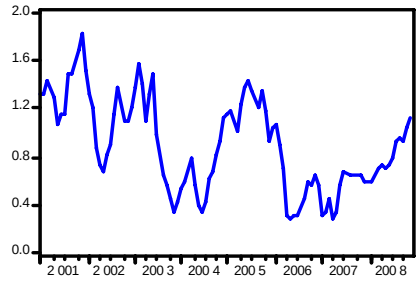
Latvia



Lithuania

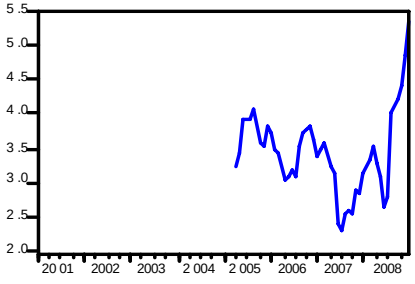


BS_MAL



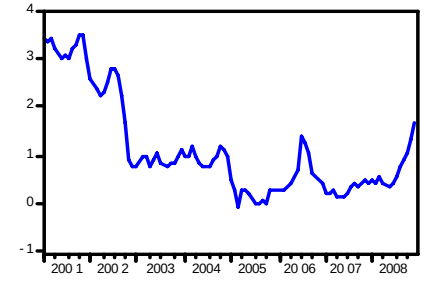
Poland

Romania



Slovenia

Slovakia



The Predicted Impact

Explanately variable	Predicted sign
• Common market factors	
VDAXNEW (volatility indicator)	+
LIQUIDITY (3mEURIBOR-O/N)	+
• Common macroeconomic factors	
CPIEU15 (CPI in EU15)	+
IPEU15 (Industrial Production in EU15)	−
• Individual macroeconomic factors	
CPI	+
IP (industrial Production)	−
DEBT (Government Debt to GDP)	+
External Balance (to GDP)	−
EXTR (Exchange trend, Euro/CEE)	−
• Individual exchange rate regime factors	
EURO (euro adoption)	−
EUROCOEF (euro coffecient)	?
ZSCORE (Z-score)	?
REGIME (exchange regime dummy)	?

Which sign?

Estimation Models

- Monthly model (by country)

$$\Delta BS_{i,t} = \alpha_0 + \alpha_1 \cdot \Delta VDAXNEW_t + \alpha_2 \cdot \Delta LIQUIDIY_t + \alpha_3 \cdot \Delta CPIEU15_t + \alpha_4 \cdot \Delta IPEU15_t$$
$$+ \alpha_5 \cdot \Delta DEBT_{i,t} + +\alpha_6 \cdot \Delta EXBAL_{i,t} + \alpha_7 \cdot \Delta CPI_{i,t} + \alpha_8 \cdot \Delta IP_{i,t} + \alpha_9 \cdot EXTR_{i,t} + \varepsilon_t$$

- Quarterly model 1 (cross-country panel)

$$\Delta BS_{i,t} = \beta_0 + \beta_1 \cdot \Delta VDAXNEW_t + \beta_2 \cdot \Delta LIQUIDIY_t$$
$$+ \beta_3 \cdot \Delta DEBT_{i,t} + +\beta_4 \cdot \Delta EXBAL_{i,t} + \beta_5 \cdot \Delta CPI_{i,t} + \beta_6 \cdot \Delta IP_{i,t} + \beta_7 \cdot EXTR_{i,t}$$
$$+ \beta_8 \cdot Exchange\ rate\ regime\ (EUROCOEF, ZSCORE, REGIME)_{i,t} + \varepsilon_t$$

- Quarterly model 2 (cross-country panel)

$$\Delta BS_{i,t} = \gamma_0 + \gamma_1 \cdot \Delta VDAXNEW_t + \gamma_2 \cdot (\Delta VDAXNEW_t \otimes Exchange\ rate\ regime_{i,t})$$
$$+ \gamma_3 \cdot \Delta LIQUIDIY_t + \gamma_4 \cdot \Delta DEBT_{i,t} + \gamma_5 \cdot \Delta EXBAL_{i,t} + \gamma_6 \cdot \Delta CPI_{i,t} + \gamma_7 \cdot \Delta IP_{i,t}$$
$$+ \gamma_8 \cdot EXTR_{i,t} + Exchange\ rate\ regime_{i,t} + \varepsilon_t$$

- Sample periods: Jan 2001 – Dec 2008

Monthly Results

With Common Factors

	Bulgaria	Cyprus	Czech	Estonia	Hungary	Latvia	Lithuania	Malta	Poland	Romania	Slovenia	Slovakia
C	0.013	0.013	-0.001	-0.039	0.028	0.042	0.051	0.007	-0.026	0.051	-0.022	-0.019
ΔVDAXNEW	0.005	0.008 *	0.001	0.026 **	0.019 ***	0.002	-0.007	0.005 **	0.011 **	-0.004	0.005	0.007 **
ΔLIQUIDITY	-0.005 **	-0.002	0.001	0.002	0.002	-0.005 **	-0.007 ***	-0.002 **	0.002	-0.004	-0.001	-0.001
ΔCPI-EU15	-0.065	-0.167	-0.025	0.100	-0.064	-0.116	-0.149	-0.040	-0.022	0.026	0.009	-0.004
ΔIP-EU15S	-0.038	-0.003	-0.004	0.025	-0.046	-0.013	-0.026	0.011	0.020	0.090 ***	-0.013	0.005
AR(1)		0.211 *	0.389 ***	-0.301 *	0.253 **	0.211	0.378 **	0.225 *	0.489 ***	0.536 ***	0.256 **	0.380 ***
Adjusted R2	0.046	0.066	0.120	0.082	0.200	0.062	0.091	0.092	0.261	0.122	0.035	0.144
Durbin-Watson	1.782	1.961	2.021	2.120	1.921	1.793	1.402	1.901	2.001	1.957	1.915	1.953
No. of observation	70	93	93	93	93	93	93	93	93	42	68	93

With Common Factors and Individual Factors

	Bulgaria	Cyprus	Czech	Estonia	Hungary	Latvia	Lithuania	Malta	Poland	Romania	Slovenia	Slovakia
C	0.022	-0.011	-0.008	-0.069	0.003	-0.028	-0.027	0.002	-0.032	0.172	-0.065	-0.001
ΔVDAXNEW	0.014 *	0.008 *	0.001	0.032 **	0.008 *	0.004	0.010 ***	0.005 *	0.010 **	-0.013	0.008	0.011 ***
ΔLIQUIDITY	-0.005 *	-0.003 **	0.001	0.005	-0.004	-0.005 **	-0.002	-0.002 **	0.001	-0.006 *	0.000	0.000
ΔCPI_CEE	-0.002	-0.016	-0.024	0.092	-0.014	0.043	0.014	-0.024	-0.074	-0.100	-0.033	-0.025
ΔIP_CEE	-0.006	0.001	0.004	0.002	0.001	0.007	-0.001	-0.001	-0.005	0.024	-0.004	0.000
ΔEXBAL_CEE	-0.008	0.089	-0.012	0.063	0.068	-0.020	0.058	-0.018	-0.178	0.099	0.076	0.023
ΔDEBT_CEE	0.064	-0.035	-0.063	0.264	0.029	0.021	-0.021	0.007	-0.007	0.660 *	-0.017	0.079
EXTR_CEE	-0.245 *	0.141	0.010	-2.583	-0.022	0.008	0.003	0.008	0.016 **	0.010	-0.108	0.020
EURO dummy		0.030						0.025			0.103	
AR(1)	0.007	0.227 *	0.375 ***	-0.308 **	0.331 **	0.172	0.155	0.195	0.546 ***	0.252	0.231	0.340 **
Adjusted R2	0.063	0.052	0.109	0.097	0.090	0.039	0.077	0.103	0.266	0.080	0.041	0.170
Durbin-Watson	1.997	1.969	1.987	2.126	1.804	1.944	1.982	1.938	1.979	1.929	1.972	1.961
No. of observation	70	93	93	93	93	93	93	93	93	42	68	93

Author's calculation.

Estimation method is a simple OLS. When serial correlation exists in residual, we include autoregressive terms (AR(1)) in the equation.If there is heteroskedasticity in residual, we estimate with White's covariance estimator.

*** significant at 1% level ** sigunificant at 5% level * significant at 10% level

Quarterly Results

euro coefficient (EC)

Cross-sections included: 11
Total pool (unbalanced) observations: 313

Variable	Coefficient
C	-0.422 ***
ΔVDAXNEW	0.014 ***
ΔLIQUIDITY	-0.001
ΔDEBT_CEE	0.007
ΔCPI_CEE	0.011
ΔIP_CEE	-0.005
ΔEXBAL_CEE	-0.005
EXTR_CEE	-0.016
EC	0.410 ***
Unweighted R-squared	0.094
Durbin-Watson	1.677

Variable	Coefficient
C	-0.426 ***
ΔVDAXNEW	0.017
ΔVDAXNEW×EC_CEE	-0.004
ΔLIQUIDITY	-0.001
ΔDEBT_CEE	0.007
ΔCPI_CEE	0.012
ΔIP_CEE	-0.005
ΔEXBAL_CEE	-0.005
EXTR_CEE	-0.015
EC	0.413 ***
Unweighted R-squared	0.093
Durbin-Watson	1.673

z-score (Z)

Cross-sections included: 11
Total pool (unbalanced) observations: 313

Variable	Coefficient
C	0.028
ΔVDAXNEW	0.013 ***
ΔLIQUIDITY	-0.001
ΔDEBT_CEE	0.001
ΔCPI_CEE	0.017
ΔIP_CEE	-0.005
ΔEXBAL_CEE	-0.005
EXTR_CEE	-0.011
Z	-0.103 ***
Unweighted R-squared	0.084
Durbin-Watson	1.651

Variable	Coefficient
C	0.022
ΔVDAXNEW	0.020 ***
ΔVDAXNEW×Z_CEE	-0.006 *
ΔLIQUIDITY	0.000
ΔDEBT_CEE	0.000
ΔCPI_CEE	0.017
ΔIP_CEE	-0.004
ΔEXBAL_CEE	-0.005
EXTR_CEE	-0.015
Z	-0.098 ***
Unweighted R-squared	0.094
Durbin-Watson	1.692

Exchange rate regime dummy (ER)

Cross-sections included: 11
Total pool (unbalanced) observations: 313

Variable	Coefficient
C	-0.187 ***
ΔVDAXNEW	0.012 ***
ΔLIQUIDITY	-0.001
ΔDEBT_CEE	0.005
ΔCPI_CEE	0.017
ΔIP_CEE	-0.005
ΔEXBAL_CEE	-0.005
EXTR_CEE	-0.014
ER	0.224 ***
Unweighted R-squared	0.089
Durbin-Watson	1.627

Variable	Coefficient
C	-0.187 ***
ΔVDAXNEW	0.011 **
ΔVDAXNEW×ER_CEE	0.002
ΔLIQUIDITY	-0.001
ΔDEBT_CEE	0.004
ΔCPI_CEE	0.017
ΔIP_CEE	-0.005
ΔEXBAL_CEE	-0.005
EXTR_CEE	-0.014
ER	0.223 ***
Unweighted R-squared	0.091
Durbin-Watson	1.634

Author's calculation.
Estimation method is a Fixed Effect Model with cross section weights. *** significant at 1% level ** sigunificant at 5% level * significant at 10% level

Empirical Results

- Monthly Analysis by country
  - Most individual macroeconomic factors have no impact on bond spreads.
  - European market factor have main impact on bond spreads in NEM countries.
- Quarterly Analysis by cross-country panel
  - All coefficients of exchange rate regimes are significant and consistent each other.
  - **EUROCOEF is positive:** hard peg regime increases the bond spread.
  - **Z-score is negative:** more floating exchange rate regime reduces the bond spread
  - **REGIME is positive:** hard peg regime increases the bond spread.
  - **The coefficient of interaction between VDAX-NEW and z-score is negative and significant**: floating regime could reduce the bond spread when the market is volatile.

Conclusion

- There are several unique features among their strategies to change exchange rate regime in their accession process toward the euro.
- European market factors, especially the volatility index, have significant effect on bond spreads in NEM countries, while most individual macroeconomic factors have no impact on them.
- More floating exchange rate regime can reduces the bond spreads in NEM countries.
- Floating regime could reduce the bond spread when the market is volatile.

Discussion and Future research

- Our findings provide a new direction of exchange rate regime choice not only for New EU countries but also other emerging countries in crisis time.
- There are other important determinants to try to test:
  - Liquidity condition of each local bond market
  - Movement of capital flow
  - Credit rating
  - News concerning about governmental credit supply and bail-out plan
  - The decision of IMF assistance
- We have to do robustness check.